RDT&E to Advance UAS Access to the National Airspace System

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NMSU/Physical Science Laboratory Overview

- Established in 1946 to support missile testing of V-2/Aerobee rocket testing at WSPG
- Multi-disciplined, aerospace- and defense-oriented scientific and technical organization
- A TOP SECRET cleared facility
UAS Demonstrations and T&E
Las Cruces

- Denied GPS Environment
- OSD-LEWK
- DHS/Border
- Combat Search & Rescue
- Playas

T&E

- Asymmetric Threat
- IED Demo
- Orbiter

WSMR

Physical Science Laboratory
Detect, Sense, and Avoid

SAFD System Detail: Schematic

Basler Cameras
Octec Tracker Cards

Geneva FlightTEK Autopilot

Autopilot Servos

Sentinel and SAVDS

Avoidance CPU

Interface Panel

WSMR

Las Cruces

ATDSS-III

ERAST
UAS Research
Air Traffic Control Research
Approach

Field evaluation of UAS symbology at FAA Air Traffic Control locations

• Aircraft call sign

Participants

• Seattle, Albuquerque, Fort Worth, Denver, New York En Route Centers and New Orleans, Denver, High Desert (Edwards AFB), Tucson, Albuquerque TRACONs

• 53 ARTCC controllers, 46 TRACON controllers
Potential UAS Symbology

- Aircraft call signs are used by air traffic controllers to identify individual aircraft:
  - **UAV173**
  - **UM9417**
  - **UIN237** (uses aircraft registration number)
  - **UN4237** (uses aircraft registration number)

- The data block (right) appears on the controller’s radar scope. Flight progress strips (below) are printed on pieces of paper.
UAS Operator Requirements

- Landing task description
  - 3 miles from airport
  - Lined up on centerline
  - 500’ AGL
  - Substantial crosswind
  - Runway – 200’ width; 7000’ long
  - Acceptable landing parameters
    -- Runway location
    -- Heading
    -- Vertical velocity

Results

- Data included as part of book chapter
Handling Qualities

• Developing an assessment scale for UAS handling qualities. Derived from the Cooper-Harper aircraft handling qualities scale.
• The UAS handling qualities scale will be multidimensional (unlike Cooper-Harper), non-intrusive, and will not compromise flight safety.
• The development of the UAS handling qualities scale will involve two empirical phases: dimension identification and validation. After scale construction, both content validity and inter-rater reliability will be empirically evaluated.
Trust in Automation

- Conducted an experiment that found time pressure increased trust and compliance in automation. This is beneficial to overall human-automation performance when the automation is highly reliable.
- Second experiment indicated that this increase in trust carries over to second session even when time pressure is removed.
- Third experiment indicated that time pressure is only effective when task is difficult and participants feel that the automation is doing a good job.
- Fourth experiment reveals a function by which the more time given to complete the task, the less compliance participants have in the automation.
UAS Flight Test Center
UAS Regulatory Status

• No regulations exist for UAS; only guidance
• No empirical data exists to help drive regulatory development
• Access to airspace
• Civil – Experimental Airworthiness Certificate

• Public – Certificate of Authorization
Need for UAS Flight Test Center

- COA process used for public aircraft operators
- Experimental airworthiness certificates required for commercial operators
  - Data must be generated to substantial airworthiness
    - To generate data, you must be able to fly
    - To fly in the NAS, you must have an experimental airworthiness certificate
    - To obtain an airworthiness certificate, flight data are required
- No authorized flight areas exist for UAS
- FAA needs data for development of regulations
Why A Test Center?

- UAS are Different
  - Manned Aircraft under testing and development can comply with 14 CFR Part 91
  - Private Industry needs a place to do basic Research and Development
    - Many are not ready for the FAA Experimental Certification process
    - Not just for aircraft…..payloads
  - UAS are still very immature

Why NMSU?

- Experience with UAS
  - Foundational SOP’s in place and exercised
  - Ability to collect and process significant data
  - Solid and credible safety record
    - Over 8 years operational experience
  - Experienced UAS personnel

- Location –
  - “It’s not the end of the world, but you can see it from there…..”
  - Very sparsely populated
  - Low density Air Traffic
  - Climate is favorable

How?

- Establishing a Cooperative Research and Development Agreement (CRDA)
  - Outlines the risk management process similar to that being applied by FAA today
- FAA will require data on a routine basis
- NMSU is a Public Organization and thus qualifies for a COA
  - All testing/R&D will be conducted as directed by FAA under the COA
- Provides for a controlled testing environment while minimizing impact to other NAS users as well as people/property on the ground
QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.
Southwest New Mexico Airspace

- Largest DoD-controlled air and ground space in the U.S.
- Slightly smaller than Connecticut – 7,105 sq mi
- USAF air traffic control from “surface to space”

- **NMSU/PSL COA**
  >12,000 sq mi
Sweden/Arctic

- Currently performing Arctic airspace study with FAA UAPO
- Arctic overflights proposed since 2003
- CY05 USA/Sweden Space Exploration Agreement and International Polar Year with Swedish Space Corporation
- High-altitude balloon experience
Summary

- Routine access to the NAS is not yet available
- The regulatory body for UAS requires development
- Significant RDT&E is required before realistic “file and fly” in the NAS exists
- Formal studies with resulting empirical data will assist with FAA certification issues

UAS Flight Test Center provides NAS access and a T&E environment